

Information

Radial Keratotomy

A Controversial Issue in Ophthalmology

DAVID J. SCHANZLIN, MD
Los Angeles

IT HAS BEEN five years since the first radial keratotomy operation was performed in the United States. These years have been marked with heated debate and controversy regarding the safety and efficacy of this operation. This debate has spawned research on both animals and humans and many clinical series have been reported. The National Eye Institute-funded "Prospective Evaluation of Radial Keratotomy" (PERK) is also under way to determine the statistical probabilities of the safety and efficacy of this operation.

There is good evidence that eight incisions placed radially in the cornea from a predefined central zone to the corneoscleral limbus will produce central flattening of the cornea. This can be done safely in most cases. What is in doubt is the predictability of the operation. This lack of predictability is the major drawback of radial keratotomy today. Interestingly, the lack of predictability is present in the early reported clinical series and in the more recent series in which newer instrumentation and techniques have been used.

In 1981 Bores and co-workers¹ reported the results of radial keratotomy in 400 eyes of 223 patients with myopia ranging from -2 to -11 diopters, and with less than $1\frac{1}{2}$ diopters of astigmatism. A surgical procedure was carried out using a #76A Beaver blade and with 16 radiating incisions extending from a premarked central optical zone to the limbus. The depth of the incision was then 75%. The results of this series showed an average postoperative refraction of -3.12 diopters in the first 97 cases and -1.18 diopters in the next 303 cases. The change in refractive error, however, was not tabulated in this study, nor was the change in keratometry readings. The reported postoperative sequelae included persistent epithelial defects, stromal edema, fluctuating visual acuity, glare and an endothelial cell loss of 6.3%.

Rowsey and Balyeat² evaluated the results of radial keratotomy done in 126 eyes of 102 patients. The patients were all older than 18 years of age and had stable myopia between -2 and -14 diopters. They evaluated various optical zones ranging from 3 mm to 5 mm and with radial incisions numbering from 4 to 16. Incisions were made with a 45-degree Superblade set at 90% of the corneal thickness. In Rowsey's re-

port, the change in keratometry ranges from 2.45 to 4.12 diopters. In all, 32% of the patients had uncorrected visual acuity of 20/20 or better, 24% had visual acuity ranging from 20/25 to 20/40 and 43% had 20/50 visual acuity or worse. Early complications of this series included perforation, persistent epithelial defects and stromal edema; late complications included fluctuating visual acuity in 48% of patients, glare in 74%, endothelial cell loss in 6.9% and overcorrection in 4% to 14% of the patients.

More recently, Arrowsmith and colleagues³ have reported their experience with radial keratotomy done by the Fyodorov technique. They prospectively evaluated radial keratotomy done in 156 eyes of 101 patients using the Fyodorov formulas. At six months postoperatively, 43% of the patients had 20/20 visual acuity, 73% had better than 20/40 visual acuity and 51% of the eyes were within 1 diopter of emmetropia. If patients who had less than 6 diopters of myopia were considered, the results were even better. Unfortunately, these results are reported as means and unless the standard error is considered, these numbers may be misleading. For instance, the mean spherical equivalent refractive error at six months was -0.2 diopters in 156 eyes; the standard deviation of this mean, however, was 2.4 diopters and the range was -9.5 diopters to $+8.4$ diopters. Stated in this statistical fashion, the authors can ensure an individual patient of a 95% chance of having a visual acuity rather than a spherical equivalent dioptric refractive error from -4.6 diopters to $+4.6$ diopters.

The reasons for the lack of predictability are not obvious. Although there are problems with quantifying and ensuring consistency of depth of incision and length of incision between operations, there are probably numerous factors that play a role in the ultimate visual acuity achieved. Even using the nomograms of Fyodorov, which take into account scleral rigidity, intraocular pressure and many other parameters, the surgical results lack the predictability desired for an operation that is done on eyes that have correctable visual acuity of 20/20 with spectacles or contact lenses.

The long-term effects of radial keratotomy are not yet known. Endothelial cell loss from the procedure does not appear at present to be a major concern; however, only long-term follow-up will ensure that the damage to the endothelium is not significant. Each physician must decide whether the risks of the surgical procedure overcome the potential improvement in visual acuity and life-style for patients.

REFERENCES

1. Bores LD, Myers W, Cowden J: Radial keratotomy: An analysis of the American experience. *Ann Ophthalmol* 1981 Aug; 13:941-948
2. Rowsey JJ, Balyeat HD: Preliminary results and complications of radial keratotomy. *Am J Ophthalmol* 1982 Apr; 93:437-455
3. Arrowsmith PN, Sanders DR, Marks RG: Visual, refractive, and keratometric results of radial keratotomy. *Arch Ophthalmol* 1983 Jun; 101:873-881

From the Department of Ophthalmology, University of Southern California School of Medicine, Los Angeles.

Reprint requests to David J. Schanzlin, MD, Estelle Doheny Eye Foundation Bldg, 1355 San Pablo Street, Los Angeles, CA 90033.